B01: Airway Management

Mike Sugimoto

Updated: February 23, 2021
Reviewed: December 04, 2020

Introduction

Airway management sits at the core of effective patient management in prehospital care. In the vast majority of cases, it is the first clinical decision to be made. All patients require a structured airway assessment during their initial evaluation, even those who are not obviously in distress.

The decision to intervene is predicated on a combination of factors. Although the patient's clinical status is the most obvious of these, consideration must be given to crew resource management, training, scopes of practice, and transport times. The interplay between these factors can be complex and daunting regardless of the experience of individual paramedics.

Airway intervention decisions can be broken down into three major categories, each of which carries with it a particular level of urgency. The first question revolves around whether there is a need to obtain or maintain an airway – this suggests there is an immediate problem that requires correction, whether that takes the form of a jaw thrust or a pharyngeal airway. The second question considers whether or not there is a problem with oxygenation or ventilation. These types of problems often require rapid intervention, either with supplemental oxygen or a bag-valve mask, or through the use of medications. The third question asks paramedics to consider what the anticipated clinical course is; if patient deterioration is expected, it may be advantageous to intervene earlier, when treatments are more likely to be effective and easier to implement, as opposed to later.

Essentials

- The goal of all airway management is effective and safe **oxygenation** and **ventilation**, regardless of modality or intervention strategy. Effective ventilation depends on sufficient tidal volume and respiratory rate; effective oxygenation depends on the fraction of inspired oxygen, the capacity for gas diffusion across the alveolar wall, the ability (and availability) of haemoglobin to transport oxygen throughout the body, and the propensity of oxygen to diffuse into tissues.
- Because end-organ and tissue perfusion depends on the ability of the body to transport oxygen in the blood, paramedics must ensure that patients have a blood pressure sufficient to support life. Volume replacement may be required before airway interventions can take place safely.
- A thorough and comprehensive respiratory assessment must be performed on all patients. Assessments of airway patency and adequacy of respiration should be performed concurrently with other elements of the primary survey.
- Intervention strategies should progress from simple strategies to more complex approaches, and must be based on an understanding of the patient's needs, rather than a technical imperative.
- If unable to ventilate in an apneic, unconscious patient, begin chest compressions regardless of the presence of a pulse and proceed as for an obstructed airway.

Additional Treatment Information

- The jaw thrust is the most effective manual maneuver to open an airway when the patient's own muscle tone is lost. In using a jaw thrust, the tongue and epiglottis are lifted away from the posterior oropharynx, maximizing the available space. Pharyngeal airways provide additional assistance at resolving these functional airway obstructions, but a jaw thrust will still need to be maintained even with the adjunct in place to ensure the best possible airway opening. There is no evidence to suggest that a nasopharyngeal airway is better or worse than an oropharyngeal airway; device selection should be based on the presence or absence of gag and airway reflexes.
- Effective bag-and-mask ventilation is a difficult skill to learn and maintain. Optimal bag-valve mask ventilation, for most cases, requires two operators: one to maintain a mask seal and provide a jaw thrust, the other to provide the bag. Lift the patient's face into the mask while providing ventilations. Exposure of the patient to visualize chest rise and fall is essential; deliver only enough volume to see chest rise, and avoid high tidal volumes.

- Critically ill patients can be supported by use of a nasal cannula with high oxygen flow rates in addition to a bag-valve mask (NODESAT or high-flow nasal cannula technique). The inclusion of a PEEP valve in this scenario provides for maximal oxygen delivery in the prehospital environment, and allows paramedics to assist ventilations if it becomes necessary.
- When applying CPAP, watch oxygen saturations carefully. Be prepared for a transient fall in oxygen saturation: this is the result of a change in the FiO_2 from a face mask to the CPAP device. Give the device time to work properly before making adjustments. Additional oxygen may become necessary if saturations remain low.

General Information

- A functional airway obstruction occurs when muscle tone in the upper airway is lost, and structures collapse under their own weight. The culprits are generally the tongue against the soft palate and the posterior oropharynx as well as the epiglottis. Functional airway obstructions should be suspected in all patients with an altered level of consciousness, and may present as snoring or stertorous respirations, asynchronous chest and abdominal movement, or irregular breathing patterns.
- Be aware of the development of pathological airway obstructions, from infectious diseases, trauma, medication reactions, or anaphylaxis. Options for managing pathological airway obstructions in the prehospital environment are limited -- epinephrine (and cricothyrotomy by advanced providers) is generally the only effective choice.
- Carefully consider the interplay between ventilation and oxygenation. Ventilation is the mass movement of gas between the lungs and the atmosphere; oxygenation is the diffusion of oxygen across the alveolar wall, the binding with hemoglobin for transport to other body tissues, and the subsequent release of that oxygen once it reaches its destination. Both are required to support life, and problems with one can affect the other, but paramedics should remember that they are distinct processes.
- Patients with ventilation deficits do not respond solely to supplemental oxygen. They may require bronchodilation (either with salbutamol or epinephrine, depending on the clinical scenario) or positive pressure ventilation by bag-valve mask. An inadequate respiratory rate, with or without a concurrent fall in tidal volume, requires immediate intervention.
- Hypoxia is the sign of an oxygenation problem. These patients may have adequate ventilation, but are unable to diffuse oxygen across their alveolar membranes (or transport oxygen in the blood). Supplemental oxygen is required in these cases.
- Continuous positive airway pressure (CPAP) masks are not ventilation devices. They are designed to improve the diffusion of oxygen across the alveolar membrane: they will not help patients who do not have an adequate respiratory rate or tidal volume. The specific FiO_2 produced by a CPAP mask is unknown due to the entrainment of ambient air required to generate the positive pressure – when using CPAP, carefully monitor oxygen saturations, and adjust flow rates as needed. It may be necessary to add oxygen via nasal cannula in critically ill patients.

Interventions

First Responder

- Assess patient and position for optimal access based on clinical need
- Provide supplemental oxygen as required to maintain $SpO_2 \geq 94\%$
  - → A07: Oxygen and Medication Administration
- Functional airway obstruction present:
  - Attempt placement of oropharyngeal airway
- Provide optimized bag-and-mask ventilation as necessary
- Monitor and providing ongoing care until paramedic arrival

Emergency Medical Responder – All FR interventions, plus:

- Functional airway obstruction present:
  - Airway reflexes intact: measure and insert a lubricated nasopharyngeal airway
  - → PR07: Nasopharyngeal Airway
- Airway reflexes absent: measure and insert oropharyngeal airway

- Consider higher level of care intercept where available

Primary Care Paramedic – All FR and EMR interventions, plus:

- Supraglottic airway devices may be used to support oxygenation and ventilation in accordance with AIME principles, following confirmation of the ability to ventilate the patient with a bag-valve mask and pharyngeal airway.
  - → PR08: Supraglottic Airway
- In non-cardiac arrest situations:
  - If SBP ≥ 90 mmHg, and unable to raise SpO_2 above 93%, consider use of PEEP
  - → PR10: Positive End Expiratory Pressure
- Consider use of CPAP (requires CliniCall consult; see individual CPGs for specific guidance)
  - → PR09: Continuous Positive Airway Pressure

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- May consider supraglottic airway device for any obtunded patient
  - → PR08: Supraglottic Airway
- Options for invasive airway intervention, in conscious patients:
  - All patients not in cardiac arrest being intubated should receive sufficient volume resuscitation prior to intubation – 500 mL NS or as clinically appropriate
  - Consider awake intubation
    - → PR23: Awake Intubation
- Consider induction for intubation
  - → PR18: Anesthesia Induction
  - → PR15: Tracheal Tube Introducer
- Following 2 failed attempts at intubation, attempt placement of supraglottic airway device while preparing for surgical access.
  - → PR22: Surgical Airways

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- May consider rapid sequence intubation as required

Evidence Based Practice

Intubation

Alternative Rescue Airway Management

Medication for Airway Management

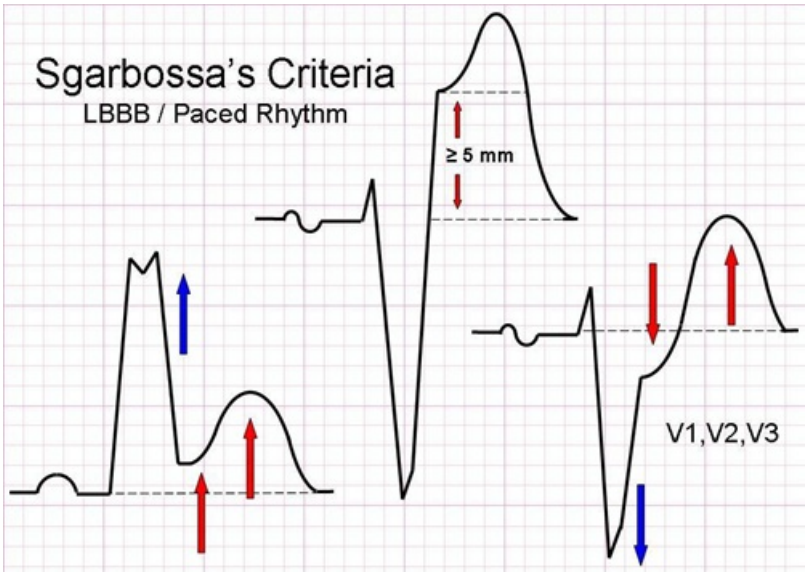
Airway Confirmation

B02: Airway Obstruction

Mike Sugimoto

Updated: November 07, 2023
Reviewed:

Introduction



aaa bbb Airway obstructions are relatively rare yet life-threatening conditions that require immediate recognition and intervention to avert disaster. Whether they are complete or partial, airway obstructions can result from foreign bodies entering the trachea, pathological conditions producing narrowing of the upper airway, or trauma to the mouth, face, head, and neck. The core treatment of an airway obstruction involves attempting to obtain or maintain a patent airway, while at the same time identifying and reversing the underlying clinical problem where possible.

This guideline focuses on foreign body airway obstructions (FBAO). Paramedics should refer to other guidelines for the management of croup, epiglottitis, or anaphylaxis as necessary.

→ B04: Croup and Epiglottitis (Stridor)

→ E09: Anaphylaxis

Essentials

- Unconscious patients should have their breathing and circulation assessed concurrently. If the patient is found to be pulseless, immediately begin chest compressions and attach a defibrillator – do not attempt to ventilate these patients prior to beginning CPR. In cardiac arrest, the lack of a patent airway is significantly less important than the need to establish circulation.
- Chest compressions are at the core of the management of a complete foreign body airway obstruction. If in doubt as to the ability to ventilate an unconscious patient, begin chest compressions. The ratio of chest compressions to ventilation attempts is unimportant, but the sequence of actions is: visualize the oropharynx, attempt to remove any foreign body that is seen, attempt to ventilate, and then resume chest compressions.
- Consider the use of patient positioning while attempting to manage partial airway obstructions, especially in facial or oral trauma. "Sit up and lean forward" can be a very useful technique when combined with aggressive suction.
- Partial airway obstructions often require only supportive care and encouragement, although paramedics must be prepared to intervene if the situation deteriorates. However, patients with a partial airway obstruction and signs of poor air exchange – stridor, weak cough, and/or cyanosis – must be treated as a complete airway obstruction.
- Rapid transport, with ACP/CCP intercept and hospital notification, is indicated for persistent airway obstruction, whether partial or complete.

Additional Treatment Information

- Abdominal or chest thrusts are indicated for complete airway obstructions in conscious patients. Use chest thrusts in pregnant women or the obese; these can be performed with the patient supine, and are identical to chest compressions in CPR. No evidence exists to support the superiority of chest thrusts over abdominal thrusts (or vice versa) in any population, and controversy exists among resuscitation councils as to the effectiveness of back blows in adult populations.
- Back blows may be effective in children under one year of age, and should be alternated with chest thrusts as necessary. Children over one year old should be managed with abdominal thrusts.
- When confronted with a patient who cannot be ventilated, advanced providers should begin chest compressions or abdominal thrusts while preparing for both direct laryngoscopy and a surgical airway. Under laryngoscopic visualization, foreign bodies may be removable using Magill forceps – do not attempt to blindly insert forceps into the airway. High vacuum suction, coupled with the Ducanto catheter, may help relieve some airway obstructions.
- Advanced providers should have a low threshold to perform a surgical airway in patients who cannot be ventilated effectively where the obstruction cannot be visualized or readily removed, or in cases of pathological airway obstruction that cannot be immediately reversed.
- Open cricothyrotomy is contraindicated in children under the age of 12. In these patients, needle cricothyrotomy can be performed instead.

Referral Information

- Paramedics should be aware that abdominal thrusts have the potential to cause significant trauma, including lacerations of internal organs. Patients who received abdominal thrusts, whether from health care providers or lay rescuers, should be transported for observation and evaluation.
- Patients with resolved partial airway obstructions, who are no longer symptomatic and are not experiencing any distress, may be left at home in consultation with CliniCall.
- Pathological airway obstructions must be transported for evaluation and treatment.

General Information

- In adults, eating is the most common precipitating event in a foreign body airway obstruction, with meat being the most likely culprit. Children, by contrast, are more prone to have non-food foreign bodies.
- Submersion or drowning victims do not, as a general rule, experience airway obstructions. The use of abdominal thrusts is not recommended for these patients; the focus should be on the initiation of chest compressions as early as possible for those who are unresponsive and pulseless, and effective bag-valve mask ventilation to address the underlying hypoxia. Patients who are conscious and breathing spontaneously may benefit from CPAP use.

Interventions

First Responder

- Position patient for optimal intervention
- For partial airway obstruction: encourage patient to cough
- For complete airway obstruction **in conscious patients**: begin abdominal thrusts
  - In children under 1 year of age, administer alternating sequence of five back blows and five chest compressions until the obstruction clears or the patient becomes unconscious.
- For complete airway obstruction **in unconscious patients**: begin chest compressions
  - → PR06: High Performance CPR
- Visualize oropharynx prior to every attempt at ventilation. Remove foreign bodies if seen. Do not attempt blind finger sweeps.

Emergency Medical Responder – All FR interventions, plus:

- Initiate transport with notification

- Consider ACP/CCP intercept

Primary Care Paramedic – All FR and EMR interventions, plus:

- Initiate transport with notification
- Consider ACP/CCP intercept

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- As above, plus:
  - Consider direct laryngoscopy for FBAO removal using forceps, with or without suction
  - Consider surgical airway
    - → PR22: Surgical Airways

Evidence Based Practice

Foreign Body Obstructions

References

1. Kleinman ME, et al. Part 5: Adult basic life support and cardiopulmonary resuscitation quality: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. 2015. [Link]
2. Atkins DL, et al. Part 11: Pediatric basic life support and cardiopulmonary resuscitation quality: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. 2015. [Link]

B03: Asthma and Bronchospasm

Mike Sugimoto

Updated: December 08, 2020
Reviewed:

Introduction

Bronchospasm is the constriction of the smooth muscles of the bronchi, resulting in narrowing and obstruction of the lower airways. The hallmark of bronchospasm is a cough with generalized wheezing, although in severe cases there may be little or no air movement, and correspondingly little wheeze; the bronchospasm can inhibit proper ventilation, provoking air trapping, and can also cause an increase in respiratory secretions, leading to mucus plugging, worsening air flow in the lungs. Asthma is a disease marked by frequent and reversible episodes of bronchospasm resulting from characteristic patient-specific triggers.

Essentials

- Nebulized beta-agonist therapy is the cornerstone of prehospital bronchospasm management; salbutamol is the medication of choice for an acute asthma attack. Addition of ipratropium has been demonstrated to improve bronchial flow and alleviate symptoms.
- In cases of impending respiratory failure or severe bronchospasm – defined as very poor to no air movement, an inability to speak, a tachypnea greater than 40/minute (or, paradoxically, a rapidly falling respiratory rate), or a falling level of consciousness – intramuscular epinephrine can be administered to provide rapid bronchodilation.
- Continuous positive airway pressure (CPAP) is available as an option to optimize oxygenation in patients who have already received bronchodilator therapy.

Additional Treatment Information

- WARNING: CONSIDER THE RISK OF INFECTIOUS DISEASE EXPOSURE WHEN PERFORMING INTERVENTIONS THAT PRODUCE AEROSOLS. NEBULIZED MEDICATIONS SHOULD BE GIVEN WITH CAUTION TO PATIENTS WITH A FEVER AND A HISTORY OF A RESPIRATORY ILLNESS. USE APPROPRIATE PPE AS NECESSARY. APPLYING A SURGICAL MASK OVER A NEBULIZER IS NOT AN EFFECTIVE REVERSE ISOLATION TECHNIQUE.
- NEBULIZED MEDICATION THERAPY IS NOT AUTHORIZED DURING COVID.
- Bronchospasm is a disease of ventilation. Although the oxygen saturation may be low, this is a result of alveolar hypoventilation and does not necessarily represent a fundamental failure of oxygen uptake or delivery. Do not over-focus on oxygenation to the exclusion of ventilation. Recall that the elimination of carbon dioxide from the body depends on minute ventilation (which is in turn based on tidal volume and respiratory rate). Critical hypercarbia can develop in severe asthma; the patient's level of consciousness and respiratory effort must be monitored closely, and aggressive action taken to support ventilation if deterioration becomes evident.
- Signs of impending respiratory failure include decreased air entry and respiratory effort, fatigue, falling level of consciousness, and slowing respiratory rates.
- Salbutamol often provokes coughing, and may temporarily worsen audible bronchospasm. Allow the nebulized medication to run its course before making additional treatment decisions, unless the patient is deteriorating rapidly. In some cases, continuous nebulizer therapy can be beneficial in optimizing drug delivery to the tissues of the bronchi; it should be considered if the patient continues to be significantly short of breath, but able to ventilate effectively, following the initial dose of salbutamol.
- Ipratropium is an anticholinergic agent that reduces airway secretions and acts as synergistically with salbutamol as a bronchodilator. Its activity is limited to the lung parenchyma, and there is little risk of systemic toxicity. PCP crews are able to transport patients who have received ipratropium provided the medication has completed its course.
- Epinephrine as an adrenergic agonist can produce dramatic bronchodilation in critically ill patients. Epinephrine should be used preferentially if the cause of the bronchospasm is believed to be anaphylaxis (see anaphylaxis CPG for more details).
- Magnesium sulphate, given intravenously, can produce bronchodilation through relaxation of smooth muscle. Its use should be reserved for patients with acutely exacerbated asthma, rather than decompensated chronic obstructive pulmonary disease.
- ***Cardiac arrest considerations***: for all asthmatic patients in cardiac arrest, and especially for patients in whom

ventilation is difficult, the possible diagnosis of a tension pneumothorax should be carefully considered and treated with extreme caution.

Referral Information

Patients with single episodes of bronchospasm and a well-established history of disease, where control of breathing is obtained quickly with a short course of inhaled bronchodilators, may be referred for follow-up in consultation with CliniCall. Patients with increasingly frequent episodes of bronchospasm, disease that is poorly controlled in the opinion of the paramedic, a consistent inability to access or use rescue inhalers, or an inability to return to their own baseline should be transported to hospital.

General Information

- Signs of a severe asthma exacerbation include tachypnea (> 30 breaths/minute), tachycardia, accessory muscle use during inspiration, diaphoresis, the inability to speak in full sentences and the inability to lie supine, but note that not all patients with severe bronchospasm will exhibit these signs.
- Patients with bronchospasm typically have a prolonged expiratory phase, often 2-3 times longer than their inspiratory phase; this is the result of the effort required to exhale against the constricted airways. In the absence of audible wheezes in a patient who is visibly short of breath, consider the inspiratory-expiratory ratio as an additional piece of information.
- Patients should be asked about their history of disease, with specific focus on previous hospital visits or admissions for asthma and current prescription drug use (including corticosteroids and bronchodilators). A history of repeated hospital visits for asthma, with or without a concurrent history of increasing bronchodilator use, is predictive for severe disease and places the patient at risk for heightened mortality.

Interventions

First Responder

- Position of comfort for patient
- Supplemental oxygen to maintain SpO_2 ≥ 94% (caution: may not be achievable)
  - → A07: Oxygen and Medication Administration
- May assist patient with own MDIs

Emergency Medical Responder – All FR interventions, plus:

- Transport early
- Consider ACP intercept

Primary Care Paramedic – All FR and EMR interventions, plus:

- Salbutamol via nebulizer
- For severe disease progressing to imminent respiratory failure: consider intramuscular EPINEPHrine (mandatory CliniCall consult).
- Consider CPAP (mandatory CliniCall Consult)
  - → PR09: Continuous Positive Airway Pressure

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Salbutamol and ipratropium (combined) via nebulizer
  - Consider continuous salbutamol nebulizer therapy: salbutamol 5 mg with an additional 5 mL NS over 20+ minutes
- Consider vascular access
  - → D03: Vascular Access
- Consider intravenous magnesium sulfate
- Consider intravenous or intramuscular EPINEPHrine for impending respiratory arrest

- Consider intubation as required
  - → PR18: Anesthesia Induction
  - → PR23: Awake Intubation

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

For obstructive lung pathologies:

- Consider intravenous dexamethasone.
- Consider mechanical ventilation.
  - → PR29: Mechanical Ventilation
  - Adjust I:E ratio to avoid auto-PEEP.
    - Decrease T_i.
    - Decrease respiratory rate (may require paralytics).
  - Accept high peak pressures.
  - Consider permissive hypercapnia.
  - Volume ventilation is generally preferred to maintain V_E.

For restrictive lung pathologies:

- Consider underlying causes of restrictive lung and correct wherever possible (e.g., restrictive straps, circumferential burns, pneumo- or hemothorax, pulmonary edema, etc).
- Improve oxygenation:
  - Consider BiPAP as required.
  - Consider intubation as required.
- Consider mechanical ventilation:
  - → PR29: Mechanical Ventilation
  - Generally, begin on ACV with a target V_t of 6-8 mL/kg (ARDSNET).
  - Increase PEEP/FiO2 to target SpO2 > 90% and/or PaO2 > 60 mmHg.
  - For persistent hypoxemia consider:
    - Recruitment maneuver.
    - Open lung ventilation strategy.
    - Pressure control ventilation (inverse ratio).
  - Consider permissive hypercapnea.
  - Consultation with EPOS is required.
- Reduce oxygen demand:
  - Consider paralysis. Requires EPOS consultation.
  - Fever reduction.
- Arterial or venous blood gas analysis for therapy guidance.
- Consider a reduced cabin altitude if transporting by air.

Evidence Based Practice

Asthma

Respiratory Distress

B04: Croup and Epiglottitis

Mike Sugimoto

Updated: December 07, 2020
Reviewed:

Introduction

Croup and epiglottitis are infectious inflammations of the upper airway. Although adults and children can develop swelling in their upper airways as a result of illness, this inflammation is significantly more pronounced in children because of their inherently smaller airways. Both croup and epiglottitis are serious medical emergencies that require early identification and intervention.

Essentials

- Epiglottitis in children is typically of abrupt onset and is associated with the "three Ds": drooling, dysphagia, and distressed breathing. Classically, children adopt a "tripod" position and are reluctant to lie down; coughing is rare. Adults may complain only of a severe sore throat, fever, and muffled voice. Do not attempt to visualize the oropharynx in these cases, unless necessary to control the airway in severely decompensated patients. Because prehospital treatment options are so limited, urgent transport to an appropriate facility is of high importance.
- The onset of croup is slower and is generally associated with a prodromal history of viral symptoms (fever, cough, nasal congestion). The barking or seal-like cough, with or without inspiratory stridor, is the hallmark of croup. Treatment of croup should be initiated regardless of the degree of stridor, as the inflammation can extend throughout the entire respiratory tract (a condition known as laryngotracheobronchitis). The most effective treatment prehospitally is nebulized epinephrine. Children who exhibit stridor while at rest should be treated with nebulized epinephrine regardless of whether they demonstrate retractions, agitation, lethargy, or cyanosis.
- Croup is most prevalent in children between six months and three years of age, and is uncommon in those over six years old.
- Paramedics should be aware of the possibility of other causes of upper airway obstruction, including foreign bodies, trauma, and inhalation injuries.

Additional Treatment Information

- Because the inflammation of croup can extend throughout the respiratory tract, compromising ventilation and oxygenation, paramedics must be aware of the potential for sudden deterioration. An early warning sign of deterioration is a fall in oxygen saturation, but supplemental oxygen can artificially prop up SpO_2, limiting the usefulness of this tool. Patients with croup should not be kept on oxygen except as necessary to provide nebulized therapy, and should be monitored closely for other signs of increasing respiratory distress.
- Although cold or hot, humid air can sometimes provide for temporary relief of symptoms in croup, these should not be considered definitive treatments.

General Information

- Epiglottitis is a cellulitis of the epiglottis and surrounding structures caused either by a bacteremia or direct invasion by pathogenic organisms. Bacteria, viruses, and fungi have all been implicated in infectious epiglottitis, but similar symptoms can be seen in cases of trauma, inhalational injury, and airway burns. Although the disease was once commonly seen in children (again, because of the significant differences in airway size), epiglottis has become comparatively rare due to routine immunization against *Haemophilus influenzae* type B (Hib) as part of childhood vaccinations. Risk factors for the development of epiglottitis, in both children and adults, include non-compliance with recommended immunization schedules and immune deficiencies.
- As a general rule, croup is caused by viral infection, and thus often presents with a history of viral symptoms (nasal congestion, cough, sore throat, fever). It is important to remember that although the primary manifestation of croup is upper airway stridor, the entirety of the respiratory tract can be inflamed (laryngotracheobronchitis).
- In both croup and epiglottitis, the tissues of the upper airway can act as a one-way valve, allowing exhalation while restricting inspiration. The prolonged inspiratory time can be a helpful tool to differentiate between upper

and lower airway inflammation. If mechanical ventilation becomes necessary, higher airway pressures may be necessary to overcome this phenomenon.

Interventions

First Responder

- Position of comfort
- Provide reassurance
- Monitor oxygen saturation and provide supplemental oxygen to maintain SpO_2 > 94%
- Provide positive pressure ventilation as required

Emergency Medical Responder – All FR interventions, plus:

- Transport early
- Consider ACP intercept

Primary Care Paramedic – All FR and EMR interventions, plus:

- Epinephrine via nebulizer over 15 minutes
  - REQUIRES CLINICALL CONSULTATION (1-833-829-4099)

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Consider need for invasive airway management in severely decompensated patients
- Consider need for antipyresis

Evidence Based Practice

Pediatric Stridor

B05: Chronic Obstructive Pulmonary Disease

Christine Hudson and Mike Sugimoto

Updated: December 07, 2020
Reviewed:

Introduction

Chronic obstructive pulmonary disease (COPD) is a progressive, degenerative structural lung disorder that results in impaired ventilation. It the result of persistent lung irritation from any of a number causes, including but not limited to smoking, chemical exposure, and repeated infections. It includes progressive lung diseases such as emphysema. Although COPD cannot be cured, it can be managed. Patients with COPD often live with some degree of respiratory distress, and frequently seek help during exacerbations of their disease, which are often prompted by respiratory tract infections.

Essentials

- COPD is primarily a disease of ventilation. Treatment should be directed towards improving overall airflow with bronchodilators and steroids.
- Critical hypercarbia can develop in patients with COPD despite high respiratory rates and apparently effective tidal volumes due to changes in the alveoli and pulmonary circulation. Monitor patients closely for signs of impending respiratory failure (a falling level of consciousness, a decreasing respiratory rate, decreasing tidal volumes) and intervene early if necessary.
- Oxygen therapy should be titrated based on what is typical for the patient. Although oxygen should never be withheld from patients who are acutely short of breath, its administration should be a considered act with due care and attention. Patients living with COPD are often very aware of their oxygen saturation when not in crisis; they, or their caregivers, can be used as a resource to guide oxygen therapy.
- When patients report a history suggestive of respiratory infections, paramedics must use appropriate personal protective equipment, and should consider deferring aerosol generating procedures until protective measures are in place.
- Recognize that treatment options for COPD exacerbations in the prehospital environment are limited. Extrication and transport should be accomplished as soon as practical and safe. Do not exert patients during transfers.

Referral Information

Patients with COPD are at significant risk for recurrent hospital admissions due to exacerbation of their disease. Paramedics should investigate whether patients have action or management plans, and assess their compliance with these programs. Self-management strategies have been demonstrated to reduce hospital admissions and improve quality of life for patients living with chronic diseases, including COPD; referral to community care organizations, either independently or through the emergency department, may be appropriate in these cases. Referral to community paramedicine programs, where available, may also provide significant improvements in quality of life.

Patients who return to baseline norms for their disease may be left at home in consultation with the CliniCall referral pathway, but in general, an exacerbation of COPD that requires paramedic attendance should be further investigated.

Community paramedics should refer to the CP COPD guidelines for additional management information.

General Information

- Patients with COPD often have comprehensive management plans prescribed by their care team. These plans reflect an individual's condition and describe a series of actions to be taken based on symptoms. Compliance with the action plan, and response to treatment, should form part of any investigation into a COPD exacerbation.
- Complete relief of symptoms, including audible wheezes, is frequently not possible. Although paramedics should be aggressive in attempting to relieve dyspnea, therapeutic end points should be set with reference to the patient's normal condition.
- In the absence of patient-specific information, paramedics should consider observable signs that describe the degree of distress. The ratio of inspiratory time to expiratory time is an important clinical clue to the

effectiveness of therapy, as is the tidal volume with each breath.

- Paramedics should consider the possibility of concurrent disease processes and seek evidence to include or exclude other diagnoses.

Interventions

First Responder

- Minimize patient activity and do not exert patients during transfer
- Titrate supplemental oxygen to SpO_2 88-92%.
  - → A07: Oxygen and Medication Administration
- Place patient in position of greatest comfort and easiest breathing (generally sitting up)
- Assist patient with use of own inhalers if prescribed
- Begin positive pressure ventilation using bag-valve masks if respiratory failure develops

Emergency Medical Responder – All FR interventions, plus:

- Transport early
- Consider ACP intercept

Primary Care Paramedic – All FR and EMR interventions, plus:

- Salbutamol via nebulizer. Allow 5-10 minutes to administer. May repeat once.
- Consider CPAP (required CliniCall consult)
  - → PR09: Continuous Positive Airway Pressure

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Salbutamol plus ipratropium via nebulizer. Repeat as necessary.
- Consider dexamethasone
- Intubate as necessary

Community Paramedic (CP) Interventions

- → CP09: Chronic Obstructive Pulmonary Disease

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- Consider use of BiPAP ventilation

Evidence Based Practice

Chronic Obstructive Pulmonary Disease

References

1. Abdo WF, et al. Oxygen-induced hypercapnia in COPD: myths and facts. 2012. [Link]
2. Austin MA, et al. Effect of high flow oxygen on mortality in chronic obstructive pulmonary disease patients in prehospital setting: randomised controlled trial. 2010. [Link]
3. Beasley R, et al. Thoracic Society of Australia and New Zealand oxygen guidelines for acute oxygen use in adults: "Swimming between the flags." 2015. [Link]
4. COMBIVENT Inhalation Aerosol Study Group. In chronic obstructive pulmonary disease, a combination of ipratropium and albuterol is more effective than either agent alone. 1994. [Link]
5. New A. Oxygen: kill or cure? Prehospital hyperoxia in the COPD patient. 2006. [Link]

B06: Pulmonary Embolism

Mike Sugimoto

Updated: May 05, 2021
Reviewed: August 18, 2020

Introduction

A pulmonary embolism occurs when the pulmonary arterial circulation becomes blocked by material originating elsewhere in the body, either fat, air, or a thrombus. The occlusion causes a variety of symptoms resulting from a combination of poor pulmonary circulation, poor gas exchange and oxygen transport, and right ventricular strain; these can include chest pain, shortness of breath, cough, hypotension, and syncope.

Essentials

- For hemodynamically normal and stable patients with signs and symptoms of a pulmonary embolism, no specific therapies are required beyond monitoring, supplemental oxygen as required, and transport to hospital. Hemodynamically compromised or otherwise unstable patients require a similar approach, but consideration must be made to the logistics of transport and the provision of en route care.
- When transporting a hemodynamically compromised patient with a suspected pulmonary embolism, paramedics should plan their transport strategy with regards to the need for effective chest compressions should the patient progress to cardiac arrest. This may require additional resources, but paramedics should not wait for additional resources to arrive before initiating transport – consider intercepts en route.
- Patients with strong suggestion of pulmonary embolism, and who are in cardiac arrest, should be transported as soon as possible, with an emphasis on effective chest compressions and early notification to the receiving facility.
- Under most circumstances, paramedics should not cease resuscitation of patients with suspected pulmonary embolism until contact with appropriate physician resources has been made.

General Information

The severity of symptoms caused by a pulmonary embolism can be extremely variable. Patients can be asymptomatic, or near death. Emboli can develop acutely, or over a longer term; there can be a clear precipitating event, or the origin of the thrombus can be uncertain. As a result, the diagnosis of pulmonary embolism can be very complex, is often subtle, and remains – even with imaging and laboratory tests – one of the most difficult diagnoses in medicine.

In the prehospital environment, the provisional diagnosis of pulmonary embolism should be reserved for those cases that unequivocally point towards that conclusion – either because of significant history findings, or as a result of clinical presentation. Suspicion will be vastly more common than certainty. History findings that should prompt a consideration of pulmonary embolism include

- Malignancy
- Pregnancy or other hormonal change (e.g., birth control)
- Recent stroke
- Recent hospitalization or restriction of movement
- Recent traumatic spinal cord injury
- Recent joint replacement
- Known thrombophilia
- Known venous thromboembolism

Common signs and symptoms of pulmonary embolism can include

- Shortness of breath at rest or on exertion
- Pleuritic chest pain
- Cough
- Orthopnea

- Calf or thigh pain or swelling
- Wheezing
- Syncope

Patients with pulmonary embolisms may present with significant hemodynamic compromise, which can progress to cardiac arrest. The possibility of a pulmonary embolism should be entertained when other causes of hemodynamic instability do not adequately account for the patient's presentation. Suspicion should be further raised when the symptoms develop suddenly and without warning.

There is no specific prehospital treatment for a pulmonary embolism. Care is primarily supportive, aimed at optimizing oxygenation and ventilation while supporting blood pressure and ensuring rapid transport to hospital.

If a patient with a suspected pulmonary embolism suffers a cardiac arrest, early consultation with both CliniCall and the receiving hospital should be made to discuss a resuscitation and potential reperfusion strategy. Thrombolysis is an option for patients whose cardiac arrests are likely due to embolic events; transport should be prioritized, with a focus on ensuring high-quality CPR during patient movement to the maximum extent possible.

Interventions

First Responder

- Provide airway management as required
  - → B01: Airway Management
- Provide supplemental oxygen as required to maintain SpO_2 ≥ 94% (caution: may not be achievable)
  - → A07: Oxygen and Medication Administration
- In cardiac arrest: begin chest compressions
  - → PR06: High Performance CPR

Emergency Medical Responder – All FR interventions, plus:

- Provide rapid transport
- Consider ACP intercept where available

Primary Care Paramedic – All FR and EMR interventions, plus:

- Consider supraglottic airway for decreased levels of consciousness when unable to ventilate using pharyngeal airways
  - → PR08: Supraglottic Airways

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Intubation as required. Avoid intubation strategies that depress blood pressure.
  - → PR18: Anesthesia Induction
  - → PR23: Awake Intubation

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- Norepinephrine
- Heparin
- Thrombolysis

References

1. Stein PD, et al. Clinical, laboratory, roentgenographic, and electrocardiographic findings in patients with acute pulmonary embolism and no pre-existing cardiac or pulmonary disease. 1991. [Link]